

CLAIMS

1. A combustion apparatus comprising:
a spraying means for spraying a fuel to be burnt,
5 a fuel channel for flowing the fuel therethrough,
a fuel pump disposed in the fuel channel so as to compress the fuel
flowing towards the spraying means,
an intermittently operating valve disposed in the fuel channel so that a
valve body of the valve is driven to close and open the channel
10 intermittently or periodically, and
a valve controller to control the timing at which the valve body is
driven to close and open the channel.
2. The combustion apparatus as defined in claim 1, wherein the valve
15 controller is designed to perform a duty ratio control or PWM control for
the closing and opening of the valve body.
3. The combustion apparatus as defined in claim 1, wherein the valve
controller is designed to control the valve body to open and close the
20 channel synchronously with an alternating current driving the fuel pump.
4. The combustion apparatus as defined in claim 1, wherein the valve
controller is designed to control the valve body to open and close the
channel synchronously with the timings of zero-crossing signals generated
25 in an alternating current driving the fuel pump.
5. The combustion apparatus as defined in claim 1, wherein the valve

controller is designed to control the valve body to open the channel upon detection of every zero-crossing signal that is generated in an alternating current driving the fuel pump.

5 6. The combustion apparatus as defined in claim 1, wherein pressure relief is executed either after or before combustion process, by keeping open the intermittently operating valve for a given duration.

10 7. The combustion apparatus as defined in claim 1, wherein a pre-combustion pressure relief is executed before combustion process, with a post-combustion pressure relief being executed after the combustion process, such that in the pre-combustion pressure relief the intermittently operating valve is kept open for a shorter time, with this valve being kept open for a longer time in the post-combustion pressure relief.

15 8. The combustion apparatus as defined in claim 1, wherein lapse of time is measured from a preceding termination of combustion process until a succeeding resumption thereof, the apparatus further comprising an ignition controller for modifying the spraying rate of fuel at the beginning
20 of a resumed combustion process and on the basis of the measured time lapse.

25 9. The combustion apparatus as defined in claim 1, wherein lapse of time is measured from a preceding termination of combustion process until a succeeding resumption thereof, the apparatus further comprising an ignition controller such that the spraying rate of fuel when re-igniting it will be reduced if the measured time lapse is equal to or longer than a given

reference time, than other spraying rates intended for any other time lapse shorter than this reference time.

10. The combustion apparatus as defined in claim 1, further
5 comprising an air-blowing means for positively supplying air to be consumed in combustion of the fuel, as well as an ignition controller for modifying the spraying rate of fuel at the beginning of a resumed combustion process, and on the basis of such a measured time lapse.

10 11. The combustion apparatus as defined in claim 1, further comprising an ignition controller such that the spraying rate of fuel when re-igniting is reduced if a measured fuel pressure is lower than a given reference value, than other spraying rates intended for any fuel pressures equal to or higher than this reference value.

15

12. A combustion apparatus comprising:
a spraying means for spraying a fuel to be burnt,
a fuel channel for flowing the fuel therethrough,
a fuel pump disposed in the fuel channel so as to compress the fuel
20 flowing towards the spraying means and,

an intermittently operating valve disposed in the fuel channel so that a valve body of the valve is driven to close and open the channel intermittently or periodically at regular and variable intervals by a duty-ratio control,

25 wherein the duty-ratio control is repeated at a frequency that is adjusted responsive to a required amount of heat to be generated.

13. The combustion apparatus as defined in claim 12, wherein the duty-ratio control involves a plurality of hypothetical regions that have different frequencies of the duty-ratio control in relation to the required amount of heat to be generated per unit time.

5

14. The combustion apparatus as defined in claim 12, further comprising a valve controller for controlling the intermittently operating valve with action relying on a plurality of electronics reference tables each being an array of valve-operating data, such that the frequencies of the duty-ratio control differ from each other between the tables, and one of them is selected to match a desired flow rate of the fuel being sprayed and burnt.

15. The combustion apparatus as defined in claim 12, wherein the one cycle time in the duty-ratio control is prolonged for comparatively lower amount of heat required to be generated per unit time.

16. A combustion apparatus comprising:
a spraying means for spraying a fuel,
a fuel channel for flowing the fuel therethrough,
20 a fuel pump disposed in the fuel channel so as to compress the fuel flowing towards the spraying means, and
an intermittently operating valve disposed in the fuel channel so that a valve body of this valve close and open the channel periodically at regular and variable intervals by the duty-ratio control,
25 the valve body fully closing the channel when it is at a first position,
the valve body fully opening the channel when it is at a second position,

wherein the duty-ratio control is repeated at a frequency that is adjusted responsive to the current flow rate of the fuel being burnt, in such a manner that if the ratio of a first time length for the valve body to move once from the first position to the second position and then back from the second position to the first position divided by a second time length in which said valve body remains at the second position during one cycle of said duty-ratio control does exceed a threshold, then one cycle time in the duty-ratio control is prolonged.

10 17. The combustion apparatus as defined in claim 16, wherein the duty-ratio control is conducted in such a manner that if the duty ratio for causing the intermittently operating valve to open does exceed a reference value, one cycle time in the duty-ratio control is prolonged.

15 18. The combustion apparatus as defined in claim 16, wherein the valve controller is designed to drive the valve body synchronously with the timings of zero-crossing signals generated in an alternating current driving the fuel pump.

20 19. A combustion apparatus comprising:
a spraying means for spraying a fuel,
a fuel channel for flowing the fuel therethrough,
a fuel pump disposed in the fuel channel so as to compress the fuel flowing towards the spraying means,
25 an intermittently operating valve disposed in the fuel channel so that the valve is closed and opened periodically at regular and variable intervals by a duty-ratio control, and

a temperature sensing means also disposed in the fuel channel in order to detect the temperature of fuel,

wherein the intermittently operating valve is to be driven at a frequency that is adjusted based on the temperature detected by the sensing
5 means.

20. The combustion apparatus as defined in claim 19, wherein the frequency of electric current for driving the intermittently operating valve is lowered if and when the temperature detected by the sensing means is
10 above a reference temperature.